What will global warming of 1.5°C and 2°C above pre-industrial levels mean for semi-arid regions?

ASSAR
Adaptation at Scale in Semi-Arid Regions

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The five-year ASSAR project (Adaptation at Scale in Semi-Arid Regions, 2014-2018) uses insights from multi-scale, interdisciplinary work to inform and transform climate adaptation policy and practice in ways that promote the long-term wellbeing of the most vulnerable and those with the least agency.

Introduction

The Paris climate agreement ambition to keep global warming below 1.5°C recognises that even this level of warming could present extremely serious adaptation challenges for the world's most vulnerable regions. Among these are the semi-arid regions (SARs) of Africa[1,2] and India[3], which already experience harsh climates, and where climatic conditions are expected to intensify over the course of the coming decades. Hundreds of millions of people live in these areas, and these changing climates could amplify their vulnerability and compromise their livelihoods and wellbeing.

To determine how SARs might be affected by different global warming scenarios, ASSAR researchers used data from the CMIP5 multi-model archive to analyse projected temperature and rainfall changes in Africa and India at 1.5°C and 2.0°C above pre-industrial levels.

This brief summarises the key messages emerging from this research.

[1] Zaroug, M., New, M., Lennard, C. 2018. National Climate Change at 1.5 and 2.0 degree Global Warming over Africa. *Env Res Letters* (submitted).

2 Nkemelang, T., New, M., Zaroug, M. *Under revision*. Temperature and Precipitation Extremes under current, 1.5°C and 2.0°C Global Warming above Pre-Industrial Levels and Implications for Climate Change Vulnerability: Botswana Case Study.

[3] Yaduvanshi, A., Zaroug, M., Bendapudi , R. *Under revision*. Regional impacts of 1.5 and 2.0 degree Global warming: implications on vulnerabilities across India.

SARs are a land-based analogue for small island developing states (SIDS)

- SARs share many of the sustainable development challenges of SIDS, including limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, and fragile environments.
- Under both 1.5°C and 2°C future global climate scenarios, climate stressors and existing vulnerabilities interact to make SARs climate change hotspots.
- Although climatic impacts will be more severe in hyper-arid areas, the relatively higher population densities of SARs will mean that a greater number of people living in these regions will be impacted by the changing climate. Consequently, adaptation challenges will be bigger for SARs than other areas.

Half a degree can make a big difference

- In climate hotspots like SARs, an increase of just half a degree in global temperatures can make a big difference, as these seemingly small increments can lead to distinct climatological conditions at local levels.
- Relative differences may be more important than absolute differences: the real implications of increasing temperatures have more to do with where you are and your current vulnerabilities, than the magnitude of the increase.
- For some people and places these climatic changes may yield positive, rather than negative, consequences. However, over most SARs, the changes will exacerbate existing vulnerabilities.

Adaptation challenges will be bigger for SARs than other areas, and adaptation strategies need to consider the timing and intensity of regional impacts, and address livelihood strategies accordingly.

Climate extremes will pose the biggest challenge

- Worse than the adaptation challenges posed by the projected changes to average temperature and average rainfall will be the challenges presented by changes to temperature and rainfall extremes.
- For example, elevated temperatures can increase the risk of heat stress and affect people's health. High temperatures and dry spells can also cause crops and livestock to approach or reach their ecological thresholds, thereby compromising people's livelihoods.
- This is particularly true in places like Southern Africa where temperatures are already high and rainfall already low.

Adapt well, adapt quickly

- At current emission rates, the 1.5°C global temperature increase mark could be crossed as early as 2024, with the 2°C mark being crossed 14 years later in 2038. This will leave very little time to respond to any associated impacts.

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